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Increases in the Rate of *Neisseria gonorrhoeae* Among Gay, Bisexual and Other Men Who Have Sex With Men—Findings From the Sexually Transmitted Disease Surveillance Network 2010–2015

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Abstract

Background—Inequalities in *Neisseria gonorrhoeae* (gonorrhea) burden by sexual minority status in the United States are difficult to quantify. Sex of sex partner is not routinely collected for reported cases. Population estimates of men who have sex with men (MSM) necessary to calculate case rates have not been available until recently. For these reasons, trends in reported gonorrhea rates among MSM have not been described across multiple jurisdictions.

Methods—We estimated of the number of MSM cases reported in 6 jurisdictions continuously participating in the STD Surveillance Network 2010–2015 based on interviews with a random sample of cases. Data were obtained for Baltimore, Philadelphia, New York City, San Francisco, California (excluding San Francisco), and Washington State. Estimates of the MSM, heterosexual male (MSW) and female populations were obtained from recently published estimates and census data. Case rates and rate-ratios were calculated comparing trends in reported cases among MSM, heterosexual males and women.

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An early version of this analysis concept using different periods, different denominator data and fewer years of data was presented as a poster at the 21st biennial meeting of the International Society for STD Research in Brisbane, Australia, September 2015.

Conflict of interest: None declared.

Results—The proportion of male gonorrhea cases among MSM varied by jurisdiction (range: 20% to 98%). Estimated MSM rate increased from 1369 cases per 100,000 in 2010 to 3435 cases per 100,000 in 2015. Between 2010 and 2015, the MSM-to-Women gonorrhea rate ratio increased from 13:1 to 24:1, and the MSM-to-MSW gonorrhea rate ratio increased from 16:1 to 31:1.

Conclusions—Estimated gonorrhea rate among MSM increased in a network of 6 geographically diverse US jurisdictions. Estimating the size of this population, determining MSM among reported cases and estimating rates are essential first steps for better understanding the changing epidemiology of gonorrhea.

BACKGROUND

The rate of reported cases of *Neisseria gonorrhoeae* in the United States has been increasing since an historic low of 98.1 cases per 100,000 population in 2009.¹ The rate among men recently surpassed that of women, with the reported case rate among men increasing 18% from 2014 to 2015 while the rate among women increased just 6% in the same time frame.¹ An increase in gonorrhea cases diagnosed and reported among gay, bisexual, and other men who have sex with men (MSM) is likely a contributing factor for the observed gender-specific trend. Increases in the number of early syphilis cases reported among MSM^{1–3} provides compelling evidence to suggest that MSM may be contributing to increases in gonorrhea as well. An effective public health response to increasing gonorrhea would likely require differential interventions depending on the relative contribution of MSM versus heterosexual men and women at the jurisdictional level.

Differences in disease rates by sexual minority status have historically been difficult to characterize. The lack of reliable data on the number of reported cases among MSM, as well as limited availability of population denominators for MSM, preclude reliably estimating case rates among MSM for most state and county-level jurisdictions in the United States. However, a previous study examining the incidence of human immunodeficiency virus (HIV) and syphilis among MSM in the United States using national-level estimates of the MSM population found significant differences between MSM, women, and men who have sex exclusively with women (MSW).⁴ Using national estimates of the size of the MSM population, the investigators calculated point estimates for incidence of HIV and primary and secondary syphilis at the national level, revealing significant differences in the burden of disease among MSM. Syphilis and HIV are conditions for which sex of sex partner information is well-ascertained through routine case surveillance for HIV cases and through partner management activities for syphilis cases.

Yet no similar data are available for gonorrhea at the national level. The gender of sex partners of persons diagnosed with gonorrhea is not routinely ascertained for the majority of reported cases in the United States, in large measure because the majority of reported gonorrhea cases are not interviewed for partner services. Most state and local health departments appropriately prioritize HIV and syphilis cases for partner services because of the severity of these infections. Only where additional capacity exists are partner services offered to persons diagnosed and reported with gonorrhea. Information about sex of sex partners for gonorrhea cases at the local level is generally available only for a limited subset

of patients, and likely constitutes a biased sample because local priorities established for targeting partner services differ widely.

To address gaps in MSM-related information available for persons diagnosed with gonorrhea, a sentinel surveillance project, the sexually transmitted disease (STD) Surveillance Network (SSuN), was established to support geographically diverse jurisdictions in conducting enhanced case investigations, including behavioral interviews, among a probability sample of reported gonorrhea cases.⁵ This project provides jurisdiction-level estimates of the proportion of all reported cases among men who also report same sex partnerships, which have been used to estimate the overall number of cases reported among MSM. This information has been used nationally to inform CDC's STD Surveillance reports¹ and provides other outcomes of interest such as treatment regimens being used to treat persons diagnosed with gonorrhea. However, these data have not yet been used to examine trends in case rates because estimates of the size of the MSM population at the county level needed for rate calculations were not previously available. National estimates of the size of the MSM population, however accurate these may be, don't address heterogeneity in MSM populations at the local level and are likely inappropriate to use for estimating rates at the state or county level. The ability to assess and compare population-specific gonorrhea rates for sexual minorities at the local level is essential to both understanding the changing epidemiology of gonorrhea as well as for developing appropriately targeted public health responses.

Estimates of the size of the MSM population at the state and county level for the entire United States have recently been published.⁶ With the availability of these denominator estimates, and data from SSuN on the proportion of gonorrhea cases attributable to MSM at the county level, we can now estimate the number and rate of gonorrhea diagnoses among MSM in 6 jurisdictions continuously participating in SSuN between 2010 and 2015. We compared trends in estimated case rates among MSM to women and to MSW to better quantify inequities in the burden of disease. To our knowledge, gonorrhea rates for MSM across multiple U.S. jurisdictions have not previously been published. Moreover, these findings may provide evidence to help interpret recent changes in observed gonorrhea cases elsewhere, suggest a rationale for refocusing STD prevention interventions where appropriate, and provide initial benchmarks for future monitoring of MSM sexual health outcomes.

METHODS

Data Collection

Surveillance coordinators in Baltimore City, California (excluding San Francisco, which is included separately), New York City, Philadelphia, San Francisco, and Washington State randomly sampled all gonorrhea cases that were diagnosed and reported in their jurisdictions in 2 SSuN project cycles 2010 to 2013 and for July through December 2015. We include only these 6 SSuN jurisdictions in our analysis because they collaborated continuously across multiple project cycles. Following common SSuN project protocols, patients in the random sample were contacted for interview. For the current analysis, we included only cases for persons 18 to 64 years of age at diagnosis to represent the sexually active adult population

and match available denominators. If a patient was reported with laboratory-confirmed infection in multiple anatomic sites simultaneously, they were counted only once as a single case of gonorrhea for calculation of case rates. Men who have sex with men were defined in our analysis as any man reporting male sex partners in the previous 3 months, reporting their sexual orientation as gay or bisexual, or identified as MSM by diagnosing providers. We chose to be as inclusive as possible in identifying male patients who do not identify as gay or report male partners so as not to exclude MSM who may have been unwilling to disclose when speaking to public health staff.⁷ Data from participating sites were collected as part of enhanced surveillance activities exempt from human subjects review; SSuN protocols were approved by the Office of Management and Budget (control 0920-0842 and 0920-1072) and did not include personal identifiers on individual patients. Data were not available for 2014 due to the transition between separate SSuN project cycles.

Design weights were developed for interviewed cases accounting for sample fraction at the county level and adjusted for nonresponse by sex and age group of the patient. Final case weights were used to estimate the proportion of male gonorrhea cases occurring among men who are MSM by year for 2010 to 2013, and for 2015. The number of gonorrhea cases among women was obtained directly from reported morbidity and the number of MSW cases was obtained by subtracting the estimated number of MSM gonorrhea cases from the reported total of male cases.

The proportion of all men estimated to be MSM in each county was obtained from recently published estimates based on the American Community Survey 5-year summary file which provides a single point estimate for the 5-year period covered by the survey.⁶ The total county population of men and women between 18 and 64 years of age 2010 to 2013 and for 2015 was obtained from U.S. Census Bureau intercensal projections.⁸ The total population of MSM aged 18 to 64 years for each year at the county level was calculated by multiplying the male population by the proportion estimated to be MSM from published estimates. Consistent with methods used to develop 5-year estimates of the MSM population, we assumed no change in this percentage over our study period. However, the number of MSM calculated for our denominator increased each year reflecting underlying population growth among all men. Similarly, population estimates for the MSW population were obtained by subtracting the estimated number of MSM from the total male population. Population of women was obtained directly from census projections. County-level estimates of the population of MSM, MSW, and women were summed to provide denominators for jurisdiction-level rate calculations for the participating SSuN sites.

Estimated Rates and Rate Ratios

Estimated annual gonorrhea case rates per 100,000 persons for 2010 to 2013 and for 2015 were calculated for MSM, MSW, women and for total reported cases based on estimates of the number of cases occurring in each group using as the denominator the estimate of MSM in the population and population of women obtained directly from the census projection. Only 6 months of interview data were available for 2013, and again for 2015; we assumed that the proportion of male gonorrhea cases reporting MSM exposure in these half-year periods was representative of the entire year and used the full year of gonorrhea cases

reported to CDC in deriving the estimates of the number MSM and MSW cases for 2013 and 2015. We calculate rate ratios by year for MSM, MSW and women to examine how MSM rates changed between these groups across the period.

RESULTS

Across the 6 SSuN jurisdictions contributing data to this analysis, a total of 306,949 cases of gonorrhea were reported among persons 18 to 64 years of age during the 2 analysis periods. Of 30,761 (10%) randomly sampled cases, we obtained information for 14,080 cases for an overall response rate of 45.7% (range across sites, 34.7%–64.9%). Across all 6 sites, overall reported gonorrhea case rate per 100,000 population increased 71.3% between 2010 and 2015, from 130.8 to 224.1 cases per 100,000. There was a variation in the overall trends between sites; sharp increases were noted in SSuN sites on the west coast (Washington, San Francisco, and California) and in New York City. However gonorrhea case rates were relatively stable in Philadelphia and decreased slightly in Baltimore between 2010 and 2015 (Table 1).

Unweighted analysis of cases among MSM reveal that 49.5% are between 20 and 29 years of age, 25.2% between 30 and 39 years of age, 39.9% are non-Hispanic White, 25.7% are non-Hispanic Black, and 24.6% report Hispanic ethnicity. Among these men, 14.0% also report having both male and female sex partners and 22.8% report being HIV-positive at the time of the interview. Based on weighted analysis across the entire study period, we estimated that 57.3% of all reported male cases occurred among MSM.

The weighted proportion of male gonorrhea cases estimated to occur among MSM varied by SSuN site and by year with a range of 20.3% in Philadelphia in 2010 to 97.6% in San Francisco in 2013. For 2015, the weighted proportion of cases among MSM across all 6 SSuN sites was 67.8% (range, 32.0%–92.5%). The total estimated number of cases among MSM by year in these 6 sites more than doubled from 13,766 in 2010 to 36,265 in 2015 (Table 1). This represents a 163% increase in the estimated number of gonorrhea cases among MSM, whereas reported cases among women increased by 45% in the same time frame.

Based on estimates of the MSM population in each jurisdiction, the calculated rate of reported gonorrhea cases per 100,000 among MSM increased overall, and for individual sites, from 2010 to 2015. The estimated rate of gonorrhea among MSM across all sites in 2010 was 1368.5 cases per 100,000 and more than doubled to 3434.7 per 100,000 in 2015. There were significant differences in the annual rates among MSM between SSuN sites, but in general, the rates for full-state jurisdictions participating in SSuN (Washington and California) were lower than for the city-level jurisdictions. The lowest estimated MSM rate across SSuN sites during the study period was 1079 cases per 100,000 in Washington State in 2011 and the highest estimated rate was 6169 cases per 100,000 in San Francisco in 2015.

The estimated rate for MSW across all sites increased from 84.3 cases per 100,000 in 2010 to 111.1 cases per 100,000 in 2015. The estimated MSW rate increased slightly in 5 SSuN sites and declined substantially in Philadelphia between 2010 and 2015. There was

considerable variation in rates among MSW by site with the highest estimated rate in Philadelphia in 2012 (525 per 100,000) and the lowest estimated rate for MSW in Washington State in 2011 (28 cases per 100,000). Among women, rates were calculated based on reported cases rather than on estimates; among all sites, the annual reported rate among women increased from 103 cases per 100,000 in 2010 to 144 cases per 100,000 in 2015. The rate of reported cases among women decreased in 3 SSuN sites, Baltimore, Philadelphia, and New York City, between 2010 and 2015.

Overall, the change in estimated rates among MSW and among women across the study period were relatively modest in magnitude, whereas the estimated rates among MSM increased substantially more (Fig. 1). Consequently, the ratio between MSM rates and those of MSW and women increased markedly across the period, with the most pronounced change occurring between 2013 and 2015. Between 2010 and 2015, the MSM-to-women rate ratio increased from 13:1 to 24:1, and the MSM-to-MSW rate ratio increased from 16:1 to 31:1. In all years, the rate ratio between MSM and MSW was higher than that observed between MSM and women. In 2015, we estimated a 24-fold difference in gonorrhea case rates between MSM and women and a 31-fold difference between MSM and MSW rates.

DISCUSSION

To our knowledge, these data from the STD Surveillance Network provide the first population-based estimates of the rate of reported cases of gonorrhea among gay, bisexual, and other MSM across multiple jurisdictions in the United States. Moreover, our analysis demonstrates a sharp increase in the estimated case rate among MSM in these 6 jurisdictions between 2010 and 2015. The rate among women and among MSW across these jurisdictions, however, showed less marked increases or even slight decreases during the same period. Rate ratios comparing rates among MSM to heterosexual males and to women reveal an important, and apparently growing, inequality in the burden of disease among MSM versus heterosexual men and women.

We were able to characterize cases and case rates among MSM in SSuN jurisdictions because the proportion of male cases reporting same-sex partnerships was estimated through enhanced surveillance on a representative sample of all reported cases. Moreover, estimates of the size of the MSM population—at the needed level of geographic granularity—are now available to facilitate estimation of population-adjusted case rates. Had we used overall national estimates of the number of men in the adult population who are MSM rather than jurisdiction-specific data, we would have significantly underestimated the size of the MSM population, particularly in our city-level jurisdictions, and consequently overestimated case rates.

Although some portion of the observed increase in reported MSM cases may be attributable to increased screening at nongenital anatomic sites, which has become a recommended standard of care for MSM sexual health,⁹ sharp increases in male gonorrhea cases noted elsewhere in the United States,¹ as well as documented increases in the incidence of syphilis among MSM, provide additional evidence that our observations of increased gonorrhea

diagnoses among MSM in SSuN jurisdictions may reflect an important, emergent trend in the epidemiology of gonorrhea.

Given the higher prevalence of HIV infection among MSM, an increase in gonorrhea in this population may have important implications for HIV transmission. Diagnoses of STDs among MSM present sentinel opportunities for HIV case finding as well as for assuring linkage of patients known to be living with diagnosed HIV to HIV-primary care. Better characterization of the rate of gonorrhea and other STDs among MSM may also contribute directly to public health actions to prevent HIV transmission. MSM living with diagnosed HIV who are diagnosed with gonorrhea should be engaged (or reengaged) with HIV care including viral suppressive therapy to reduce the risk of HIV transmission. Men who have sex with men with gonorrhea who are not known to be living with diagnosed HIV are potential candidates for interventions such as preexposure and postexposure prophylaxis to reduce the likelihood of HIV infection.¹⁰

Moreover, our observations of increasing gonorrhea diagnoses are for MSM broadly construed; we chose to use a broadly inclusive definition of MSM. Our case data include information on bisexual and non-gay-identified men who may also have female partners in addition to their male partners. The potential for bridging between higher-prevalence MSM networks and lower-prevalence heterosexual populations, contributing to a more generalized gonorrhea epidemic, is a clear epidemiologic concern. Additionally, MSM may be at greater risk for acquisition of gonococcal infections with reduced susceptibility to antibiotics, making it especially important to address this population with both enhanced surveillance, as well as intensified, MSM-appropriate disease prevention efforts.^{11,12}

There are limitations to SSuN data; estimates of the proportion of cases attributable to MSM are based on a random sample of cases interviewed in each jurisdiction. Although we adjusted for differential response rates by sex and age group, there may be unmeasured biases present in our data. It is possible that either MSM or non-MSM were more or less likely to respond to attempts by public health staff to contact them for an interview. This could result in either an underestimate or overestimate of the proportion of gonorrhea cases occurring among MSM. We have no evidence to suggest bias in either direction, but because information on sex of sex partners is generally not ascertained for cases who are not interviewed by public health staff, we have no way to independently assess response rates among MSM.

Additionally, confidence intervals associated with our estimates of MSM vary in magnitude depending on the fraction of cases sampled and response rate. We performed a sensitivity analysis assuming the lower value of the 95% confidence interval for the proportion of male cases attributable to MSM for 2015 (53.7% of males vs the midpoint of 61.6%), and still found a 20-fold and 23-fold difference in the rates between MSM, and women and MSW, respectively, using these lower estimates. No confidence intervals or standard errors are as yet available for the published MSM denominator estimates so we were unable to conduct a fuller sensitivity analysis. We did not have interview data for 2014 due to implementation of new SSuN data management protocols, but these changes were unrelated to methods of case sampling, patient recruitment and ascertainment of sex of sex partners. Interview questions

related to sex of partners and sexual orientation remained consistent across the entire period in these 6 jurisdictions. Our annual estimates for 2013, and again for 2015, are based on 6 months of data rather than for a full year as for 2010 to 2012. For the purposes of visualizing our data in Figure 1, we assumed that the trend between 2013 and 2015 was linear (shown as a dashed line in the figure), which might have masked significant variation across this gap in data.

Many jurisdictions in the United States are increasing both the screening frequency and range of anatomic sites tested among MSM presenting for care in STD clinics in response to national recommendations.⁹ Increased screening of nongenital sites for MSM may be identifying a previously undiagnosed, asymptomatic burden of anorectal or pharyngeal infections, leading to an increase in reported cases. We surmise that some of the increased burden of disease we detected among MSM during our study period is likely attributable to increased anorectal and pharyngeal testing. Yet, arguing against additional screening explaining all or most of the change in the burden of disease we detected among MSM, only a modest decrease in the proportion of all male cases reporting symptoms was observed during this same period (67.7% of cases in 2010 to 57.9% in 2015, data not shown).

Finally, SSuN jurisdictions were not selected to be representative of all states, cities and counties in the United States. There is likely considerable variation in these measures across the national landscape, but because there is considerable travel and mobility in all populations, and increases in male gonorrhea have been observed in many other locations nationally, we posit that these findings may be suggestive of trends elsewhere. Despite limitations, these data demonstrate an increasing trend in reported gonorrhea cases among MSM in collaborating SSuN sites and highlight the need for additional focus on ascertaining sex of sex partner information on cases reported in other areas experiencing significant increases in male gonorrhea cases.

CONCLUSIONS

Gonorrhea case rates among MSM increased in a diverse group of US jurisdictions between 2010 and 2015. The burden of gonorrhea in this population in 2015 was estimated to be greater than 30 times that observed among MSW and 24 times that of women. Inequality in the burden of disease for MSM of this magnitude, documented now for both syphilis and gonorrhea, challenges the public health community to better address the prevention, diagnostic, and treatment needs of this population in new and innovative ways and highlights the need for a more robust local, state, and national response to a particularly acute sexual health inequity in an historically marginalized population. Continuing development and use of state, county, and local area estimates of the size of the MSM population (with appropriate standard errors as these become available), as well as efforts to ascertain or estimate the proportion of reported cases occurring among MSM are critical for furthering our understanding of the changing epidemiology of gonorrhea, for improving MSM health outcomes and for preventing a more generalized national gonorrhea epidemic.

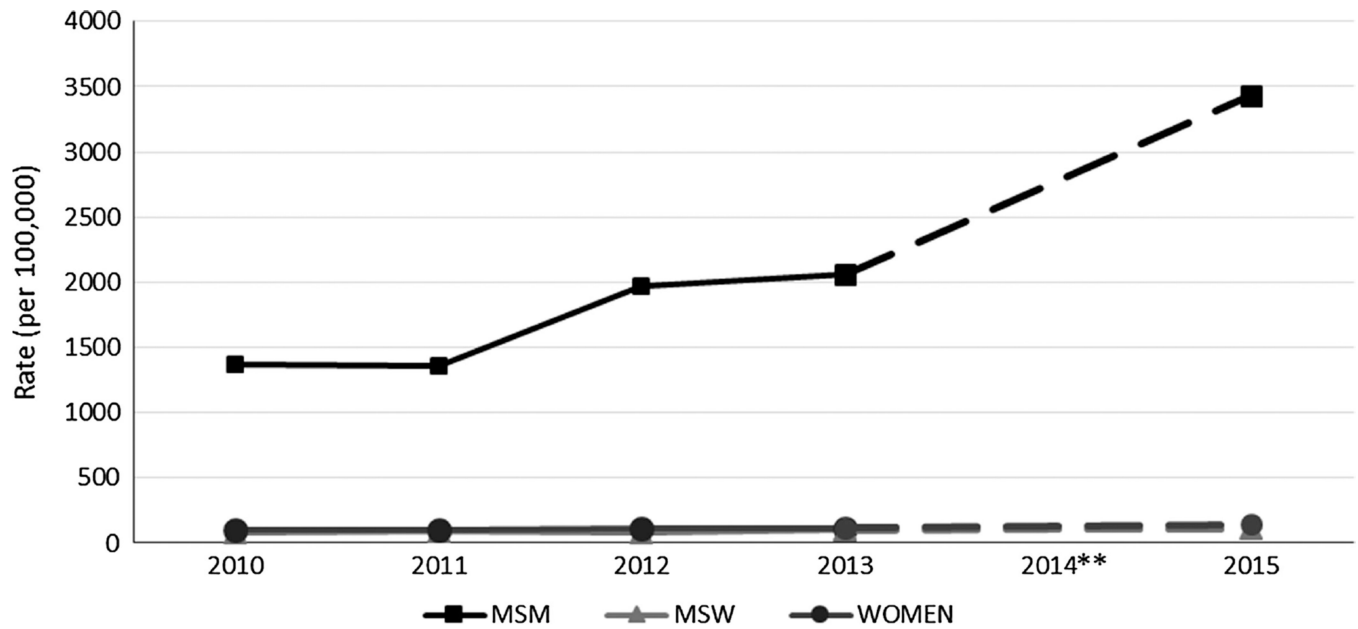
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Note: Trend lines for MSW and Women overlap substantially in this figure.

*Estimated case rate for MSM, MSW; reported case rate for Women; MSM defined as men reporting male sex partners in prior 3 months, reporting gay or bisexual orientation or reported by providers as MSM.

** Data for 2014 not available; linear interpolated (indicated with dashed line) between 2013 and 2015 data points.

Figure 1.

Gonorrhea—trend in estimated gonorrhea case rate among MSM, MSW and Women*, 6 SSuN Sites, 2010–2015.

TABLE 1

Estimated Number of Gonorrhea Cases and Case Rate per 100,000 Population Among MSM, MSW, Women and Total by SSuN Site, 2010–2015

	Baltimore			California*			New York City			Philadelphia			San Francisco			Washington			SSuN Total		
	Cases	Rate [†]		Cases	Rate [†]		Cases	Rate [†]		Cases	Rate [†]		Cases	Rate [†]		Cases	Rate [†]		Cases	Rate [†]	
2010																					
MSM [‡]	326	2324.9		7336	1183.4		2909	1520.0		597	2062.2		1465	2585.9		1134	1193.4		13,766	1368.6	
MSW	928	507.7		6122	55.6		3620	150.8		2344	525.5		160	64.2		634	30.5		13,809	84.3	
Women	1415	647.8		8767	75.9		4207	148.5		2515	479.8		228	80.9		895	41.6		18,027	102.7	
Total	2669	642.7		22,996	96.3		10,737	197.9		5456	546.1		1867	317.6		2665	61.6		46,390	130.8	
2011																					
MSM [‡]	238	1694.3		7274	1159.5		2806	1446.3		731	2503.2		1757	3064.5		1042	1079.1		13,848	1359.6	
MSW	833	454.3		6561	58.9		4709	193.6		2231	495.7		232	92.1		595	28.2		15,161	91.5	
Women	1086	495.6		9080	77.7		4801	167.7		2555	482.3		192	67.3		940	43.3		18,654	105.1	
Total	2157	517.8		28,885	98.1		12,322	224.5		5517	546.8		2197	369.4		2577	58.9		53,655	135.2	
2012																					
MSM [‡]	300	2136.5		10,393	1640.2		5492	2802.1		843	2865.2		2130	3658.0		1094	1122.4		20,251	1968.5	
MSW	524	285.5		7021	62.5		2900	118.1		2507	553.3		104	40.6		863	40.7		13,920	83.3	
Women	809	367.9		11,385	96.7		4580	158.9		2841	532.4		194	67.2		1098	50.3		20,907	116.9	
Total	1633	391.3		33,305	122.2		12,991	234.8		6191	609.2		2438	404.3		3055	69.4		59,613	155.0	
2013 [§]																					
MSM [‡]	373	2662.7		10,466	1635.5		5649	2864.3		1069	3619.0		2240	3805.2		1558	1577.9		21,356	2056.7	
MSW	623	340.3		10,206	90.1		2670	107.9		2056	451.8		56	21.5		1047	49.0		16,657	98.9	
Women	864	394.3		12,600	106.1		3826	132.0		2321	434.0		168	57.7		1570	71.6		21,349	118.5	
Total	1860	447.0		39,519	139.7		12,200	219.0		5446	534.3		2483	407.7		4175	94.3		65,683	165.7	
2015 [§]																					
MSM [‡]	371	2675.4		19,830	3043.9		8339	4186.0		1590	5365.5		3712	6169.0		2423	2387.8		36,265	3434.7	
MSW	790	436.0		10,805	93.9		3500	139.9		1735	380.0		296	111.8		1867	85.4		18,993	111.1	
Women	927	426.1		16,362	135.8		3846	131.8		2125	396.6		380	127.8		2555	114.4		26,195	143.5	
Total	2088	506.1		47,058	194.4		15,759	280.4		5451	533.3		4407	708.2		6845	151.4		81,608	224.1	

* California state data exclude San Francisco, which is presented separately.

[†] Estimated case rate per 100,000 population 18–64 years of age.[‡] MSM defined as men reporting male sex partners in prior 3 months, reporting gay or bisexual orientation or reported by providers as MSM.[§] Estimates based on MSM data collected January to June 2013 and July to December 2015 and annualized using total reported cases among men aged 18 to 64 years for those years.